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REGENERATIVE BRAKING WITH POWER MONITORING IN ELECTRIC VEHICLES

Anitha C.[1], Bhargavi S.[2], Chinmaye C. G.[3], Madhavi S.[4]

[1] Assistant professor, Department of Electronics and Communication Engineering, S J C Institute of Technology, Chickballapur, India
[2] Student, Department of Electronics and Communication Engineering, S J C Institute of Technology, Chickballapur, India
[3] Student, Department of Electronics and Communication Engineering, S J C Institute of Technology, Chickballapur, India
[4] Student, Department of Electronics and Communication Engineering, S J C Institute of Technology, Chickballapur, India

ABSTRACT

The duration of battery charging and the scarcity of charging stations are the main obstacles to the widespread usage of electric vehicles. We thus suggest a regenerative breaking system here. Every time the brakes are applied, a car might produce energy thanks to this mechanism. More power is produced with stronger brakes. In a braking drum, we employ a friction lining arrangement. The friction liner on a rotating drum does not wear down the drum. When the brakes are applied, the friction lining within the drum touches it, moving the motors attached to it in the same direction. This process uses the motors as a dynamo to produce electricity. This method so provides a regenerative braking system by enabling the automobile battery to be charged each time the brakes are used. It affects us both in different ways.

KEYWORDS: Dynamo, KE, Electrical Energy, LCD, Arduino IDE, Power Efficiency

1. INTRODUCTION

As it stands, relying solely on finite petroleum resources will prevent vehicles from ever becoming widely used. As a result, developing electric vehicles is a crucial and significant way to address issues. Batteries are the power source for electric vehicles. Mileage remains a "curse" on the advancement of electric car technology. As one of the primary determinants of driving mileage, battery technology has advanced significantly; yet, recent advancements have been limited by technological and financial constraints.

Therefore, research on brake energy recovery technology has gained popularity as a significant way to lower energy consumption and increase vehicle mileage. Brake energy can account for up to 50% of the total energy.If a portion of the waste energy is reusable, the driving distance will be extended.

In electric and hybrid cars, regenerative braking is a feature that recovers and stores part of the energy that would otherwise be wasted as heat during braking. Reusing this energy will increase overall efficiency.

2. METHODOLOGY

1. Detection: To ascertain whether regenerative braking may be activated, the system keeps an eye on a number of parameters, including vehicle speed, accelerator and brake pedal positions, and battery level.
2. Engagement: The regenerative braking system engages when the driver depresses the brake or accelerator pedals. The control system of the car has the ability to accomplish this automatically.
3. Conversion: Using electric motors or generators that double as brakes, the system transforms the vehicle's kinetic energy into electrical energy. These motors/generators slow down the car by producing energy instead of the conventional friction brakes. The electricity is either put back into the battery or utilized to power other electrical systems in the car.
4. Energy Management: Regenerative braking produces electrical energy, which is controlled.It can be used to run the auxiliary systems,replenish the vehicle's battery,or supplement the drivetrain with extra power as needed.
5. Integration: The regenerated energy is combined with other power sources like the engine and batteries to form part of the vehicle's overall energy management system. Optimizing energy efficiency and raising total car performance are the objectives.
6. input: Some regenerative braking systems give the driver input, such as audio or visual indicators, to let them know when and how much energy is being recovering during regenerative braking.

3. BLOCK DIAGRAM

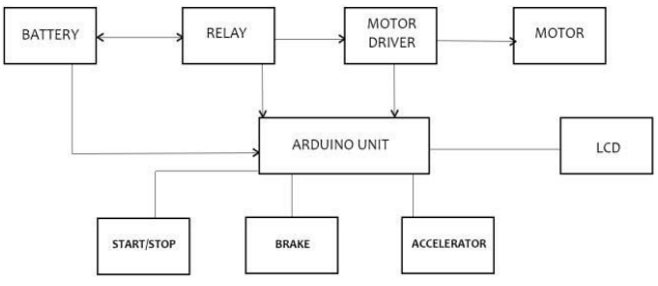

Fig 1: A complete system design

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4. COMPONENTS

The following materials place a important role in Regenerative braking system:

1. Dynamo
   - Dynamo or commonly known as Electric generator, used in regenerative braking system to convert kinetic energy into electrical energy during braking.

2. Brakedrum
   - In a regenerative braking system, a brake drum can be used as a component of the braking mechanism. When the brakes are applied, the brake drum provides resistance to the rotation of the wheels, converting kinetic energy into heat energy through friction. This process helps slow down the vehicle.
   - The brake drum can still be used as a backup or secondary braking system. In situations where regenerative braking alone may not provide sufficient braking force (e.g., during emergency stops or when the battery is fully charged), the brake drum can engage to provide additional braking power and ensure safe deceleration of the vehicle. This combination of regenerative braking and traditional friction braking with the brake drum allows for optimal control and safety in varying driving conditions.

3. Battery
   - The purpose of the regenerative braking system is to store the electrical energy generated during the conversion purpose.
   - The battery aids in both storing and utilizing the electrical energy that is being converted in regenerative braking system, when there is necessary.

4. Arduino IDE
   - Arduino IDE is a software tool used for writing, compiling, and uploading code to Arduino microcontroller boards.
   - Arduino board can interface with various sensors such as accelerometers, wheel speed and velocity measurement sensors etc..

5. ATmega328P AVR MC
   - The ATmega328 can be used to control Regenerative braking process. It monitor the vehicle's speed and other relevant parameters to determine when braking is needed and engage the regenerative braking system in progress.
   - It also measure various electrical parameters such as voltage, current, and power using sensors.

6. 16*2 LCD
   - It provides real-time feedback showing graphical representation of energy flow during braking events.
   - It additionally can display warnings or alerts related to regenerative braking performance or system malfunctions.

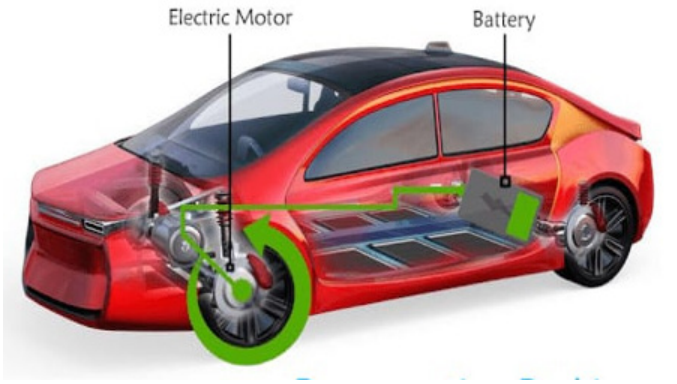
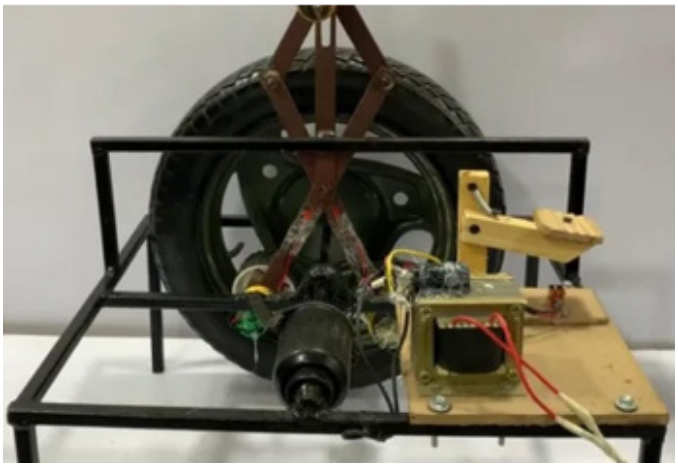


Fig 2: Regenerative braking system

Any source other than the charging station that can produce extra energy is vital when the battery charge is limiting the range of an electric car. Regenerative braking DPT is therefore a viable and effective method of boosting mileage. Furthermore, considering that these losses were completely ignored just ten to fifteen years ago, 70% of the energy saved is a positive indicator.

5. RESULTS

Regenerative braking has several advantages, including recharging the vehicle's batteries while it is braking, lowering maintenance costs, extending the life of the disc and drum brakes, reducing brake non-exhaust emissions, and reducing heat energy emissions.



Calculations

Parameter	Frequency,%	Avg Power with-out RBS, kw	Avg Power with RBS, kw
Acceleration	15.8	21.8	19.5
Deceleration	0.0	25.2	0.0
Stationary	0.0	8.0	0.0
Constant Speed	10.0	45.0	2.9
Increase in efficiency	51.7%		

6. CONCLUSIONS

Regenerative braking allows electric vehicles to recover energy that would otherwise be lost during braking, increasing overall

efficiency and extending driving range. It also reduces wear on traditional braking systems, leading to longer maintenance intervals and cost savings for owners. Additionally, regenerative braking contributes to a smoother driving experience by providing consistent deceleration. However, its effectiveness can vary depending on driving conditions and vehicle design, and it may not fully replace traditional friction braking in all situations. Nonetheless, it remains a valuable feature in modern electric vehicles for enhancing efficiency and performance.

Regenerative braking systems for electric cars have generally been found to be beneficial. Electric vehicles can increase overall efficiency and extend driving range by recovering energy lost during braking through a process known as regenerative braking. Additionally, it lessens wear on conventional brake systems, which extends maintenance intervals and lowers owner costs. Furthermore, by offering steady deceleration, regenerative braking makes driving more enjoyable. Its efficiency can differ based on the type of vehicle and the driving environment, therefore it could not always be a complete substitute for conventional friction braking. However, it continues to be a useful element for raising performance and efficiency in contemporary electric vehicles.

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